NOTES ON INSECT PESTS IN ANTIGUA.*

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(Plates VIII and IX.)

The principal object of my visit to Antigua, during December 1912, was to study an outbreak of the twig borer of limes† which had been reported by the Superintendent of Agriculture from two localities in the island.

At the time of my visit, owing to recent pruning, there were only occasionally infested branches to be seen, but these were in sufficient number to enable me to form a very good opinion of the nature of the attack and of the general habits of the insect.

The attack on a lime branch apparently always begins on a small twig. I am not able to say whether the twig on or in which the egg is laid is dead or dying at the time of egg-laying ; but in every instance of attack observed by me, both in the field and in specimens forwarded, the twig has been found entirely eaten out, the dead interior connecting with the tunnel in the larger branch from which the twig springs. This branch is always more or less girdled by the tunnel of the grub. The girdling seems to be the first thing done by the grub after completing the destruction of the smaller twig and it results in the death of the branch beyond the point of the girdle. The tunnel does not circle the twig in such a manner as to cut it off completely, but the direction is rather in a spiral, so that as the injury to the branch becomes more and more felt, it breaks down and is usually left hanging. The entire grub and pupa stages are passed within this branch, the adult beetle only issuing from the dead branch some time after emerging from its pupal condition.

The length of the life-cycle is not known. The number of eggs laid by a single female, and the other food-plants on which they are laid, are also still to be learned. With regard to the length of life-cycle, it may safely be said to be comparatively long, since specimens have been found, both larva and adult, in lime twigs which had apparently been dead for a long time, and it seems likely from what we know that this insect begins to feed in living wood.

It is possible that this insect has occurred as a pest of limes in Antigua for some time but has been overlooked. It is also probable that it has a considerable range of food-plants from which renewed attacks on limes may be experienced from time to time. The presence of this insect, however, should not, in my

* [Extracted from a Report submitted to the Secretary of State for the Colonies by Dr. Francis Watts, C.M.G., Commissioner, Imperial Department of Agriculture for the West Indies.—Ed.]

† [Specimens of this insect have been forwarded for identification by Dr. Francis Watts ; it proves to be *Elaphidion mite*, Newman, a Longicorn of the family Cerambycidae. The species has also been recorded from St. Thomas, St. Bartholomew, St. Kitts, Guadeloupe and Brazil.—Ed.]

opinion, prevent the development of the lime industry in Antigua, as it ought to be a fairly easy pest to control. Within a very short time from the beginning of the attack the grub injures the branch in which it is to complete its development to such an extent as to make the injury very conspicuous. First of all the leaves wilt, then discolour and dry up ; about this time the branch breaks at the point of girdling and usually hangs in the tree, forming a very conspicuous notice of the presence of the beetle (Plate VIII).

The remedy to be employed is therefore obvious. Any dying branch on which the leaves are curling up or turning yellow should be carefully examined for the presence of the borer, and if the grub can be found it may easily be dug out or the branch cut off sufficiently far back toward the tree to ensure the removal of the grub. It is more likely that the attacked branches will most often be detected after the breaking down has occurred and then the point at which the branch should be cut is clearly indicated. When the branch has broken the grub will always be found in that part of it beyond (or outside of) the break. If all these broken branches in which the grubs occur can be collected and burned, say at intervals of one month, it ought to be possible so far to reduce the numbers of this insect that it would no longer be a pest.

The loss of the attacked branches in the first instance, is, of course, an important item from the lime-growers point of view ; but if this system of collecting is carefully carried out, there will probably be very little infested material to collect after the first two or three times, because the destruction of all the developing grubs over a period of three or four months will very largely preclude the development of further broods of the insect.

The lime twig borer is different in appearance and in habit from the lime bark borer (*Leptostylus praemorsus*), which has at times been plentiful in Dominica and is known to occur in several other islands. The latter lives entirely under the bark, the attack generally beginning in the vicinity of a patch of dead bark caused by bad pruning or other injury. Its tunnels sometimes extend into living tissue and very rarely enter the centre of the stem. The attacks of this insect usually occur on the larger branches and the main stem, often near the ground-level where the plant has been injured by hoe or cutlass.

The attacks of the twig borer, on the other hand, always occur higher up in the tree, among the smaller branches and twigs. The branches which are girdled and break off are usually not larger than one inch in diameter, generally $\frac{5}{8}$ or $\frac{3}{4}$ of an inch. Occasionally, however, branches larger than one inch have been found girdled ; some of them were broken off (Plate VIII), while in others, either the injury was sufficient to kill the branch above without its breaking off at the point of attack, or the attack has been stopped and the tunnel filled with gum. It is not possible to say exactly what arrested the progress of the grub in forming these tunnels, but it may be that the amount of gum secreted by the plant was sufficient to cause the death of the insect before the injury was extensive enough to cause the death of the branch.

In several localities the orange red scale or California red scale, *Chrysomphalus* (*Aspidiotus*) *aurantii*, was observed in such abundance and under such conditions that it appeared to be doing very serious damage. Young limes two or three years old, are being killed by it (Pl. IX, fig. 1) and in another older lot of trees,

of, say, ten or twelve years of age, this scale was so abundant as to be causing serious injury. Where the trees are oldest (some 30 or 40 years) many have died out and others are dying.

In the case of the older trees, the infestation is often more severe, but the trees being better established have not actually died to quite the same extent as noticed amongst the younger ones. A characteristic feature of the attack of this red scale is that the scales often, if not generally, completely cover the lime fruits before the attack on the leaves and branches is serious enough to attract attention on the part of the casual observer, although a planter accustomed to dealing with this insect would perhaps be aware of its presence some time before this happens.

At the time of my visit these limes had experienced, in common with Antigua generally, a most severe drought. I am of opinion that this scale-insect is essentially a dry weather scale, that is to say, in dry situations it develops and spreads much more rapidly than under conditions of moisture. I am not aware that there is any fungus associated with moist periods or moist conditions which exercises a check on this insect, and must only conclude that the young are probably very easily washed off the plant by heavy rains while they are still in a free, moving condition.

One conspicuous result of severe attack on the lime fruits is that they split open, and this splitting is possibly to be accounted for in the following way. Enormous numbers of these minute insects sucking the juices from the skin of the lime cause it to become incapable of growth, and when, on the advent of rain, the fruits attempt to increase toward their normal size the pressure produced by the growth of the interior of the lime causes the skin to burst.

The occurrence of the orange red scale (*A. aurantii*) has been recorded several times since Mr. H. M. Lefroy first mentioned it in the report on his visit to Antigua in August 1900. Mr. Lefroy expressed in strong terms the danger from this pest. I mentioned it in my report on my visit in 1906, and again in my report in 1911.

I believe this insect to be the cause of the most serious injury from which the limes are suffering, and in the absence of efficient natural control, some artificial remedy must be used to enable the limes to recover. Accordingly, I arranged with Mr. Tempany for certain trials to be made in the use of insecticides, suggesting "Scalo" prepared according to Mr. Moore's formula, the application being made by means of the Autospray, a compressed air sprayer.

Other scales which were noted on limes during the visit to Antigua are as follows:—Purple scale (*Lepidosaphes beckii*), snow scale (*Chionaspis citri*), lantana bug (*Orthezia insignis*) and West Indian red scale (*Selenaspidus articulatus*). It is of interest that the green scale was absent, or at least not noted, and that there was very little black blight. The scales mentioned are of general occurrence on limes in Antigua, but at this time they were not present anywhere in unusual numbers.

At one spot, limes which had not been cultivated for some years have been cleared of bush, and they appear to be in good condition and but little troubled by scales, although the red, purple and white scales are all present. In another case also limes which have been recently cleared of bush are in much better

condition than others which have been cultivated and kept free from bush. This accords with experience in other places where it has been found that neglected, overgrown limes are generally free from scales, even though grown in the near vicinity of badly attacked, unhealthy trees. In one instance many of the young trees had recently been overgrown by rapidly growing weeds, such as *Ipomoea umbellata*, a white-flowered butterfly pea (*Clitoria sp.*) and another leguminous vine called wina (*Teramnus sp.*). I was informed that such trees had no scales when the vines were first removed.

At the base of a number of trees, nests of ants, the stinging ant or fire ant (*Solenopsis geminata*) and a carpenter ant (*Camponotus sp.*), were to be seen. In order to find if the presence of ants had any relation to the infestation, I made notes on this point; but it would appear that in this instance ants had no influence on the presence of this species of scale-insect.

Wherever red scale was abundant in Antigua there were two ladybird beetles in numbers; one of these was the red ladybird (*Cycloneda sanguinea*) and the other a minute black or bluish black species, not larger than a pin's head.

During this visit every opportunity was taken to examine cotton for any signs of the presence of the flower bud maggot, but no such indications were seen; though this pest has since been reported by Mr. Jackson as being found on the 29th December.

In two plantations boll-worm was present and in one instance had done a considerable amount of damage. At this place cotton and corn were planted together, and it is likely that the corn has provided breeding places for a large number of boll-worms which had gone from the corn to attack the cotton. This transference may take place either by the larvae leaving the corn plant and going over to the cotton, or the larvae may attain their full growth in the corn, the moths of the following generation depositing their eggs on the cotton. I advised that the corn should be removed at once and all the stalks fed to the stock, such ears as were ripe enough being kept for grain. I also recommended that children should be sent into the cotton to collect all injured bolls, which should be destroyed by being turned into the cattle pens. It was further suggested that by planting corn through the field at once it might provide an attractive place for egg-laying when the moths from the worms which escaped the other methods of collection should mature; but if this were done it would of course be necessary to cut the corn and feed it out before any worms which might attack it should have an opportunity of becoming full fed.

In the second plantation boll-worms were less numerous, but they had done an amount of damage. The attack here was mainly on the younger bolls and on the buds, and the larvae apparently wandered from one bud or boll to another and having eaten out the interior moved on again. Several of these worms were observed, generally attacking bolls which were so small that the caterpillar could not get entirely inside them. The presence of a small amount of Guinea corn in these fields of cotton probably accounted to a large extent, at least, for the presence of the boll-worm.

At Skerretts' Experiment Station a number of interesting things were observed. Cassava was attacked by the cassava worm, the larva of the common Sphingid moth (*Dilophonota ello*). These larvae were of two kinds, green and

purple. In a recent letter Mr. Tempany gives an account of rearing the adults from these larvae. He separated them into two lots and found that the green larvae remained green and the purple larvae remained purple until fully grown. The larvae of both colours pupate in exactly the same manner, and when the adults emerge the moths from the two lots of caterpillars are alike.

A small plot of castor, which was being grown for experiment in Eri silk culture, was found to be attacked by considerable numbers of a leafhopper, while both the cassava and castor were attacked by a lace bug (*Corythuca sp.*).

The sweet potatoes at Skerretts were attacked by the larvae of a butterfly (*Junonia sp.*).* This is a delicate and spiny caterpillar about 2 inches in length, and was fairly abundant throughout these plots. The occurrence of this butterfly larva as a pest on sweet potatoes is very unusual, at least I have never observed it before. The ordinary potato worm, *Herse* (*Protoparce*) *cingulata*, occurs as a pest of sweet potatoes in Antigua, but I saw no instance of it during this visit. A small green caterpillar was present feeding on the potatoes in the plots, but I was not able to obtain the adult.

The cow-peas at Skerretts were attacked by a boring larva in exactly the same manner as those found by me in Barbados in 1911 from which a new species of moth was reared. The attack on Canavalia, which I reported having observed in St. Kitts in the early part of 1912, was also similar in nature to this. I was very interested to observe the large numbers of a predaceous bug which occurred in these cow-peas at Skerretts. This insect (*Zelus rubidus*) has often been reported in different places in the West Indies, but I have never before seen it in such numbers. I am of opinion that it was present because of the large number of the larvae of the cow-pea or woolly pyrol moth (*Thermesia gemmatalis*). These larvae were causing a certain amount of injury to the cow-peas and the predaceous bug was present on all the plants.

* [Probably *Precis lavinia zonalis*, Feld., the only species of the genus known as yet from Antigua. The larvae of another Nymphalid butterfly (*Acraea terpsichore*, L.) have been recorded by Mr. C. C. Gowdey as damaging sweet potatoes in Uganda.—Ed.]

Lime trees in Antigua, showing branches broken by the attacks of the Lime Twig Borer *(Elaphidion mite*, Newm.).

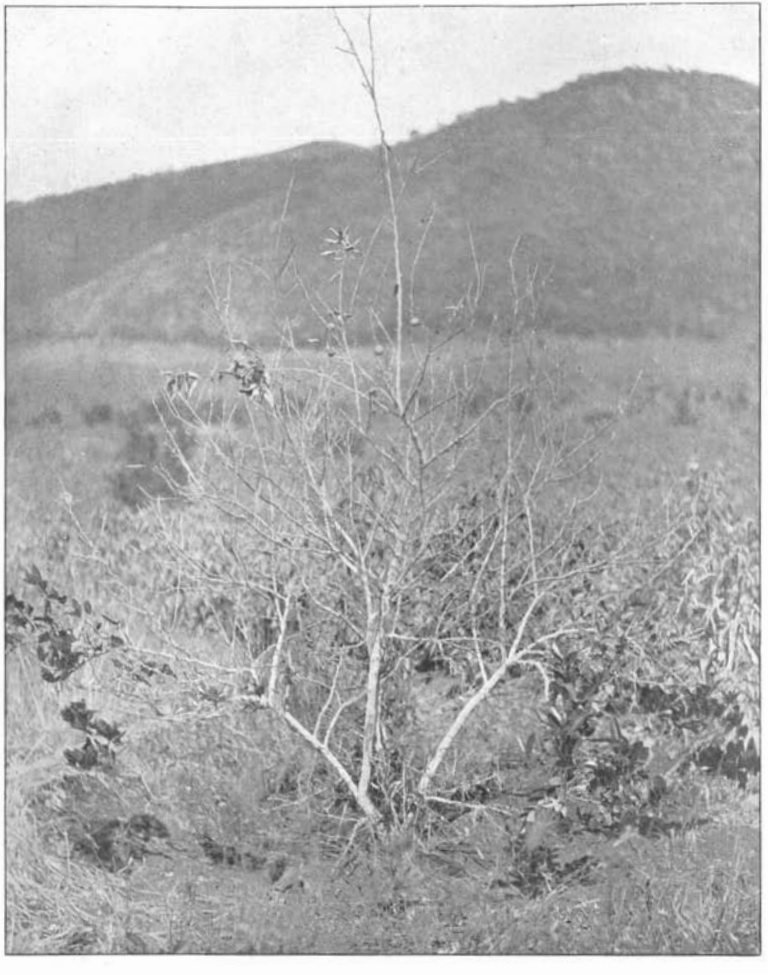

Fig. 1. Young lime tree nearly killed by the attacks of California Red Scale (*Chrysomphalus aurantii*).

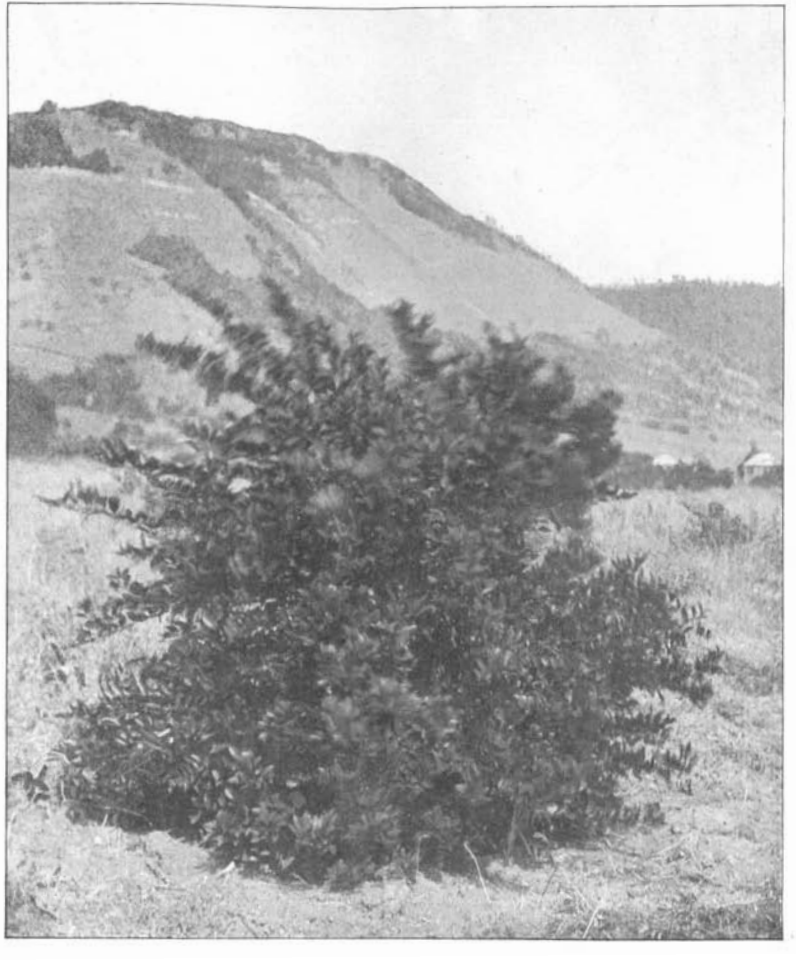

Fig. 2. A healthy young lime tree.